CLAIMS

1. A photodetector (10) comprising at least one active zone (31) for detecting optical radiation and a structure (4), arranged on said active zone (31), intended for optically coupling the optical radiation, characterized in that said structure combines the properties of coupling gratings and Bragg gratings and has at least one defect which, from an incident wave, makes it possible to obtain a plasmon wave which is both coupled and localized in the active zone, said active zone having dimensions which are small compared to those of said structure.

2. The photodetector (10) as claimed in claim 1, characterized in that the active zone has an elongate shape and said structure is composed of grooves which are mutually parallel and parallel to the length of the active zone (31).

3. The photodetector (10) as claimed in claim 2, characterized in that the structure (4) is produced in a layer (41) of at least one dielectric material which is transparent in the spectral range of the optical radiation, said layer comprising a substantially plane lower face (410) in contact with the active zone and an upper face (411) comprising the grooves of the structure, said face being covered with a metal film (43), and in that the optical thickness of said layer separating the lower face from the upper face along an axis (Ox) perpendicular to the direction of the grooves and parallel to the plane of the lower face (410) varies as the superposition of at least one first so-called coupling grating whose pitch has a first spatial frequency and a second so-called localization grating whose pitch has a second spatial frequency that is two times the first spatial frequency and which comprises a central spatial defect.

4. The photodetector (10) as claimed in claim 3, characterized in that the layer (41) constituting the structure is made from an isotropic dielectric material, and in that the profile of each groove along the axis

perpendicular to the direction of the grooves is composed of mutually parallel plane facets with different heights.

5. The photodetector (10) as claimed in claim 3, characterized in that the layer (41) constituting the structure is made from a material composed of mutually parallel alternate layers (412, 413) of equal thickness and a central layer of double thickness, said layers alternately comprising a first material having a first permittivity and a second material having a second permittivity, the plane of the layers being perpendicular to the plane of the lower face, and in that the profile of each groove along the axis perpendicular to the direction of the grooves is composed of regular crenellations with a pitch two times greater than the thickness of the alternate layers.

6. The photodetector (10) as claimed in one of claims 3 to 5, characterized in that the optical thickness of said layer (41) separating the lower face from the upper face varies along an axis (Ox) perpendicular to the direction of the grooves and parallel to the plane of the lower face, whose origin is centered on the center of the grating, as a function which is the sum or the difference of:

- a first function which is proportional to the sign function of the cosine function of the distance from the origin of said axis and has a period equal to that of the pitch of the grooves; and
- a second function which is proportional to the sign function of the cosine function of the absolute value of the distance from the origin of said axis and has a period equal to half that of the pitch of the grooves, said second function being phase-shifted by one half-period with respect to the first function.

7. The photodetector (10) as claimed in one of claims 3 to 5, characterized in that the optical thickness of said layer (41) separating the lower face from the upper face varies along an axis (Ox) perpendicular to the direction of the grooves and parallel to the plane of the lower face, whose origin is centered on the center of the grating, as a function which is the sum or the difference of:

- a first function which is proportional to the sign function of the sine function of the distance from the origin of said axis and has a period equal to that of the pitch of the grooves; and
- a second function which is proportional to the sign function of the cosine function of the absolute value of the distance from the origin of said axis and has a period equal to half that of the pitch of the grooves, said second function being phase-shifted by one half-period with respect to the first function.

8. The photodetector (10) as claimed in one of claims 6 and 7, characterized in that the proportionality coefficient of the first function is two times that of the second function.

9. The photodetector (10) as claimed in one of the preceding claims, characterized in that the pitch of the first grating of the structure is approximately equal to half the average wavelength of the incident radiation divided by the average optical index of the structure.

10. The photodetector (10) as claimed in claim 1, characterized in that said two-dimensional structure (4) is composed of patterns with substantially identical dimensions, in that the active zone (31) is centered on said structure and in that the dimensions of the active zone are substantially equal to the average dimensions of the patterns.

11. The photodetector (10) as claimed in claim 10, characterized in that the structure (4) is produced in a layer (41) of at least one dielectric material which is transparent in the spectral range of the optical radiation, said layer comprising a substantially plane lower face (410) in contact with the active zone and an upper face (411) comprising the patterns of the structure, said face being covered with a metal film (43), the optical thickness of said layer separating the lower face from the upper face varying:

- along a first axis parallel to the plane of the lower face (410), as at least one first grating whose pitch has a first spatial frequency;

- along a second axis perpendicular to the first axis and parallel to the plane of the lower face, as at least one second grating whose pitch has the same first spatial frequency; and
- along an oblique third optical axis at 45 degrees to the previous two, as at least one third grating whose pitch has a second spatial frequency equal to half the first spatial frequency.

12. The photodetector (10) as claimed in claim 11, characterized in that when the layer (41) constituting the structure is made from an isotropic dielectric material, each pattern is composed of mutually parallel plane facets with different heights.

13. The photodetector (10) as claimed in one of claims 11 and 12, characterized in that the optical thickness of said structure (4) separating the lower face from the upper face varies along two mutually perpendicular axes, which are parallel to the plane of the lower face and whose common origin is centered on the center of the structure, as a function which is the sum or the difference of:

- a first function which is proportional to the sign function of a first cosine function of the absolute value of the distance from the origin proportional to the sign function of the cosine function first axis, said first cosine function being phase-shifted by plus or minus 90 degrees with respect to the origin;
- a second function which is proportional to the sign function of the cosine function of the absolute value of the distance from the origin along the axis perpendicular to said first axis and has a period identical to that of the first function, said second cosine function being phase-shifted by plus or minus 90 degrees with respect to the origin;
- a third function which is proportional to the sign function of the sine function of the difference between the distances to the origin along the first axis and the second axis.

14. The photodetector (10) as claimed in one of claims 10 to 13, characterized in that the dimensions of the patterns of the structure are approximately equal to half the average wavelength of the incident radiation divided by the average optical index of the structure.

15. The photodetector (10) as claimed in one of the preceding claims, characterized in that the active zone (31) is surrounded by an optically passive zone (32) with dimensions substantially equal to those of the structure (4).

16. The photodetector (10) as claimed in claim 15, characterized in that the active zone (31) is a quantum well structure.

17. A photosensitive matrix comprising a plurality of photodetectors organized in rows and columns, characterized in that said photodetectors are as claimed in one of the preceding claims.